

Managing the transition to low carbon domestic heating

Angel Team



Premise

- 14% of UK GHG emissions is from homes (Committee on Climate Change)
- To reach the UK's net zero target, the use of natural gas needs to be reduced to near zero
- A one size fits all solution is probably not appropriate for the UK
- Need to consider the possibilities and constraints imposed by the existing utility networks and usage patterns when designing the future state

Dec 2019 CO₂ on Mauna Loa – 411.76 ppm

End Goal

- Meet UK's net zero target
- Define the future state of UK domestic heating
- Manage the transition to the future state, minimizing financial and non-financial costs to all stakeholders

84% of UK homes are heated by gas

Questions that need to be answered

- What portions of the electrical network will be most or least stressed by the shift from domestic use of gas?
- Are there any portions of the gas network that should be kept and converted to a low-carbon fuel, rather than shifting load to an alternative?

2018 - 24M users connected to gas grid

Data we used and how we integrated it

- BEIS consumption – calculated total annual domestic electricity and gas consumption and number of meters by full post code
- Electralink consumption/reading data – estimated electrical distribution networks from area post codes (full post code not available)
- Integration was limited by not have full post code for each MPAN

> 20k houses/week need to switch

What our data shows

Post Code (area)	Ratio of gas/elec meter quantity	Ratio of gas/elec consumption	Electrical Distribution region	Electrical DNO (Distribution Network Operator)
AB (Aberdeen)	A	a	Northern Scotland	SSEN
AL (St Albans)	B	b	Eastern England	UKPN
...				
YO (York)	Y	y	North Eastern England	NP
ZE (Lerwick)	Z	z	Northern Scotland	SSEN

8.6% of houses are heated by electricity

Additional Data we want to use and why

- Time and spatially granular electrical and gas consumption data
- Commercial and industrial electrical and gas consumption data
- Cross reference meter information to electrical infrastructure at lowest possible level
 - determine impact of changes in consumption to the existing infrastructure
- Database of disengaged & disadvantaged customers
- Mapping M/LLSOA (middle, local level super output areas) data to our data set
 - plan communication and assistance plans
- Sources of geothermal heat
- Sources of concentrated waste heat
 - Determine where local district heat networks could be appropriate

2.5M UK people live in fuel poverty

Who will use this data and how

- UK Government to inform domestic heating strategy
- Distribution Network Operators (DNOs) to plan electrical infrastructure improvements
- Gas Distribution Networks (GDNs) to plan gas infrastructure changes
- Ofgem to hold DNOs & GDNs to account
- Local Authorities to support the local transition plans
- Consumers to be informed and engaged in decision making process

Emissions need reduce by 7.6%/year

Thank you

Backup info

Actors

- Government - BEIS and delegated administrators, Local Authorities
- Regulator – Ofgem
- National Grid (various entities)
- Electrical Generators/Interconnectors
- Electrical Transmission companies
- Electrical Distribution companies
- Gas Distribution companies
- Electrical Retail Suppliers
- Gas Retailer Suppliers
- Consumers

Plot

- Currently the UK domestic sector consumes 100TWh of electricity and 300TWh of gas annually, out of total UK consumption of 300TWh of electricity and 500TWh of gas.
- Government needs to complete a heat policy roadmap as part of net zero commitment
- Gas consumption is not evenly distributed across the country, so some areas will see more change in electrical demand than others
- Electrical generation, distribution and transmission companies need to plan the upgrades to the system to support increased electrical consumption to replace existing gas consumption
- Use post code level data of electrical and gas consumption to identify where to focus electrical infrastructure upgrades, as well as identify areas where the full switch to electricity is not practical and local alternatives need to be developed
- Warn consumers of how their local availability of gas will change so they can plan purchases of replacement boilers and appliances

Front Stage

- Government – Information of the scale of the issue to inform upcoming “heat policy roadmap”
- Infrastructure companies – data portal to allow planning of infrastructure changes
- Consumers – notifications by bill and other communication of how and when the gas infrastructure will change

Pain Points / Opportunities

Pain Points

- Stranding of existing gas infrastructure
- Upgrading of existing electrical infrastructure
- Need to replace existing gas consuming appliances with alternative technologies

Opportunities

- Use funds that would be spent on updating infrastructure to reduce and balance electrical demand, reducing need to upgrade infrastructure
 - Home insulation to reducing heating demand
 - smart local electrical grids with local generation and load shifting
 - Use gas infrastructure to distribute low carbon fuels where shift to electricity isn't practical

Supporting Data

- Table / Map of areas with highest and lowest impact of shift from gas

Back Stage

Next Steps

Immediate

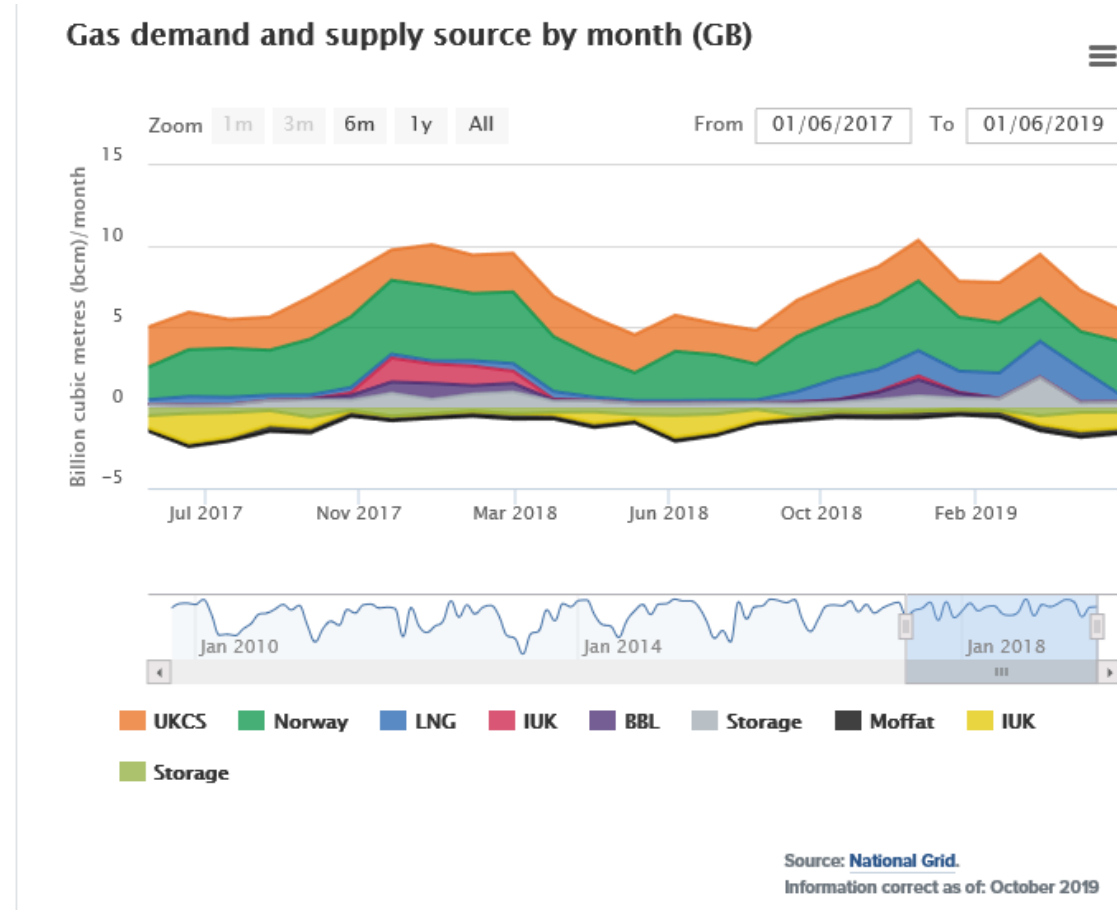
- Cross-reference fuel poverty data for consumers that will need assistance making the transition
- Convert the detailed data into a impact score available at the full post code
- Change planning restrictions to allow for improvements to household energy efficiency

Medium Term

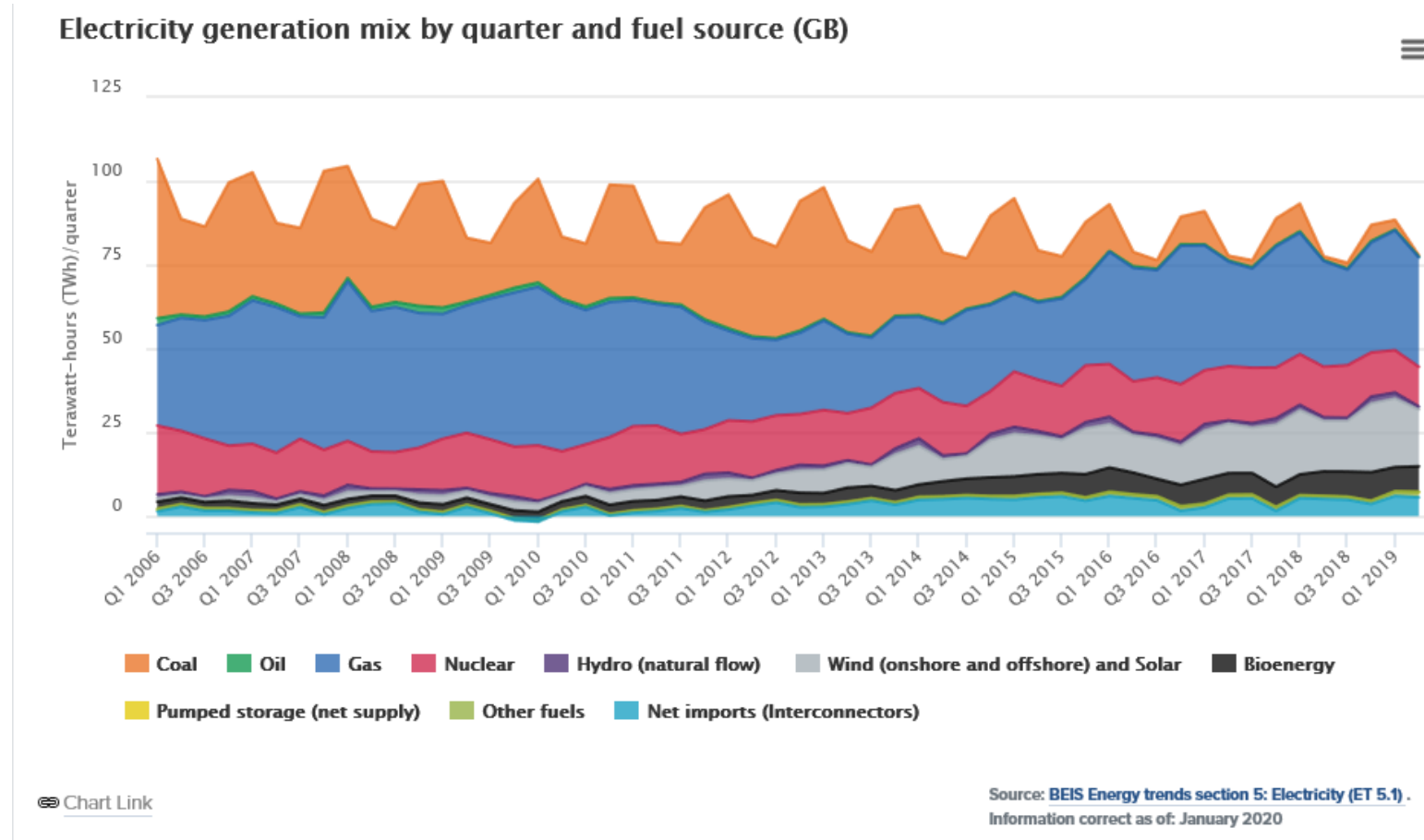
- Develop the strategy for replacing gas infrastructure across the UK
- Plan and implement the electrical infrastructure improvements needed to generate and distribute the additional electricity
- Develop, plan and implement the alternative strategies for regions where it is impractical to fully substitute gas with electricity
- Develop an interface to allow consumers to determine which strategy is planned for their location, so they can make the required adjustments

Appendices

UK Gas monthly consumption (6/17-6/19)

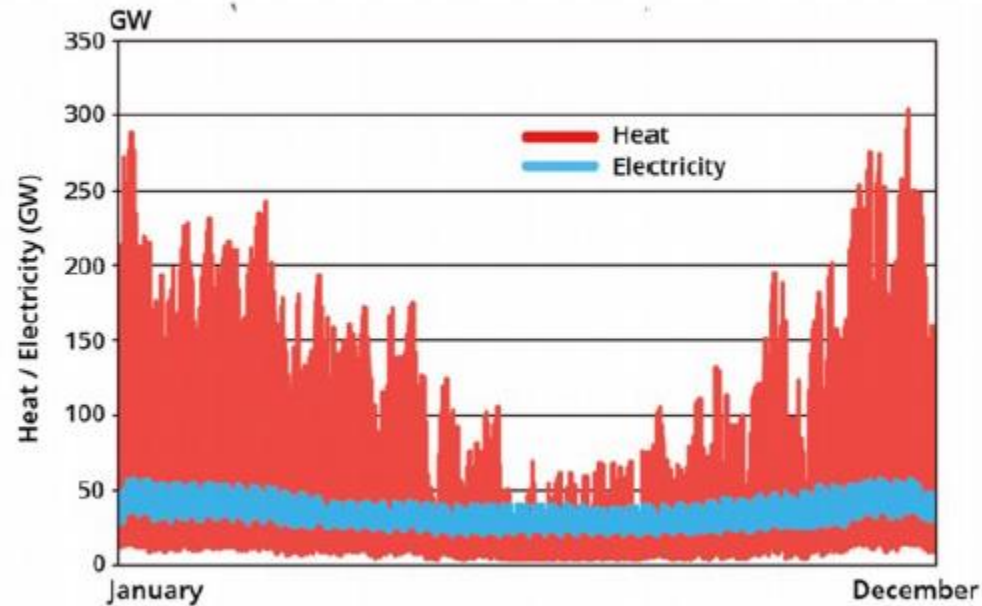


UK quarterly electricity generation (2006-18)



Comparison of domestic gas & electricity consumption

Figure 4: A comparison of electricity and (non-industrial) heat demand



Source: Sansom, R. (2015) Decarbonising low grade heat for a low carbon future, PhD thesis

UK post code map

